

JAPANESE [JP,2002-076965,A]

CLAIMS DETAILED DESCRIPTION TECHNICAL FIELD PRIOR ART EFFECT OF THE
INVENTION TECHNICAL PROBLEM MEANS DESCRIPTION OF DRAWINGS DRAWINGS

[Translation done.]

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CLAIMS

[Claim(s)]

[Claim 1] It is the wireless terminal which receives the radio signal ****(ed) from a base station by the communication mode specified by the software built in, and acquires information data from a base station. The 1st storage section the communication-mode software which specifies the communication mode when acquiring information data from a base station is remembered to be, Change to the communication-mode software memorized by the 1st storage section, and it has the 2nd storage section the standard communication-mode software which specifies the communication mode when acquiring the communication-mode software updated from the base station is remembered to be. this — Renewal of the communication-mode software memorized by said 1st storage section is faced. While acquiring the communication-mode software which received the radio signal ****(ed) from a base station by the standard communication-mode software memorized by said 2nd storage section, and was updated from the base station concerned The wireless terminal characterized by carrying out the updating storage of the acquired communication-mode software concerned which was updated at said 1st storage section.

[Claim 2] It is the record medium which recorded the program for changing the communication-mode software of a wireless terminal by computer. This program is made to be changed to the standard communication-mode software to which the communication-mode software used until now [of a wireless terminal] is set beforehand in the case of renewal of the communication-mode software of a wireless terminal. Standard communication-mode software is made to receive the updating communication-mode software by which wireless transmission is carried out by standard communication-mode software from a base station. The record medium which recorded the updating program of the communication-mode software of the wireless terminal characterized by making the received updating communication-mode software concerned changed to said standard communication-mode software and in which computer reading is possible.

[Claim 3] An analog-to-digital-conversion means to change into a digital signal the analog signal received on radio, A recovery means to restore to the digital signal outputted from this analog-to-digital-conversion means by software processing, A processing software supply means to supply the software for recovery processing to this recovery means, A control signal supply means to supply the control signal for controlling the specification of each of said means of operation, The 1st memory section which memorizes communication-mode software including the software which said processing software supply means supplies, and the control signal which this control signal supply means supplies, It has the 2nd memory section which memorizes the standard communication-mode software for updating the communication-mode software memorized by the 1st memory section. this — In renewal of the communication-mode software of said 1st memory section The updating storage of the standard communication-mode software memorized by said 1st memory section at said 2nd memory section is carried out. Wireless receives the communication-mode software updated by said analog-to-digital-conversion means and recovery means which operate through said processing software supply means and a control signal supply means with this standard communication-mode software. The wireless terminal

characterized by changing and memorizing the updated this communication-mode software for standard communication-mode software at said 1st memory section.

[Claim 4] The wireless terminal according to claim 3 characterized by attaching the 3rd memory section by which archival memory of the communication-mode software which was being used at every renewal of the communication-mode software memorized by the 1st memory section concerned until now is serially carried out to said 1st memory section.

[Claim 5] Renewal of the communication-mode software memorized by said 1st memory section is faced. It judges whether it is the same as that of the wireless interface of the communication-mode software which the wireless interface of the communication-mode software updated was using until now. Only when not the same, the updating storage of the standard communication-mode software memorized by said 1st memory section at said 2nd memory section is carried out. Wireless receives the communication-mode software updated by said analog-to-digital-conversion means and recovery means which operate with this standard communication-mode software through said processing software supply means and a control signal supply means. The wireless terminal according to claim 3 characterized by changing and memorizing the updated this communication-mode software for standard communication-mode software at said 1st memory section.

[Claim 6] The base station characterized by having a transmitting means to transmit the communication-mode software of two or more different classes from the communication-mode software concerned of 1 for renewal of a wireless terminal with the communication-mode software of 1 defined beforehand at least.

[Claim 7] It is the base station according to claim 6 characterized by the communication-mode software of two or more classes including the information on the latest version in said transmitting means.

[Claim 8] Said transmitting means is a base station according to claim 6 characterized by having always transmitted the communication-mode software of two or more classes.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to renewal of communication-mode software, such as a wireless interface, in the wireless terminal which used the software wireless technique, and its base station.

[0002]

[Description of the Prior Art] By performing the communication link between highway and vehicle with the wireless beacon and the mounted terminal which were installed in some places of the side strip of a road as an intelligent transport system (ITS being called Intelligent Transport System and the following), the road traffic information transmitted from a wireless beacon is received, and the system which displays the duration to path guidance or a destination on a mounted terminal screen, and the electronic toll collection system for tariff accounting in a highway are being put in practical use. Moreover, the system which realizes much more safety operation is also considered by performing the communication link between cars further from now on.

[0003] Thus, the wireless terminal used for these systems is adapted to the system of varieties as the system of varieties is proposed, even if it mentions ITS as an example. Moreover, since it has possibility of upgrading each [these] system every 2 or 3 years, the wireless terminal used for these systems is adapted also to this version up with rapid development of communication technology. In response to these situations, the wireless terminal using the software wireless technique as a wireless technique in which installation, the existing system use modification, etc. of a new system can be flexibly coped with as a wireless terminal used for these systems attracts attention.

[0004]

[Problem(s) to be Solved by the Invention] At the wireless terminal using this software wireless technique, required radio-signal processing is described by software and radio-signal processing is performed according to this software. Therefore, in order to update the radio-signal processing, what is necessary will be just to update the software corresponding to it.

[0005] In this case, since the software corresponding to radio-signal processing is stored in the memory built in the wireless terminal or the base station, it is carried out by rewriting the contents of storage of this memory. There is a method of transmitting the software concerned to the memory of a wireless terminal from IC memory card which, for example, made the software of new radio-signal processing memorize as one of the approach of this of rewriting. However, this approach has the trouble that it is necessary to prepare IC memory card for every renewal of software.

[0006] Moreover, since the intention to want to make the correspondence procedure and wireless interface updated in the above-mentioned ITS service is an intention by the side of service, a user is expected the approach to which a burden is not applied as much as possible. Therefore, the establishment of a method which a service provider transmits [establishment] the updating data of the software corresponding to radio-signal processing to a user's wireless terminal by wireless through a base station, and makes the correspondence procedure and

wireless interface of ITS service in the wireless terminal concerned update is required.

[0007] Then, if it is going to transmit updating data to a wireless terminal by wireless from a base station, the technical problem whether transmitting using which radio system is suitable will occur first. Furthermore, the radio method of a user's wireless terminal changes also with used services. For example, if a lot of updating data are transmitted by this communication mode when the communication mode with a low transfer rate has received service, the long transfer time will be taken and it will become what has the bad user-friendliness for a user. On the other hand, when the service which a user can transmit at high speed is being used, that service may be a charge, and since a tariff occurs for updating, the problem who pays this tariff is also generated in this case.

[0008] In the radio method in which the user is doing current use on the other hand, a wireless interface remains as it is, and it is necessary to establish the updating method based on the situation when updating to want to change into another radio method of still more nearly another service, and to communicate with the latest version of the radio method to update a signal-processing protocol, namely, perform modification and updating to coincidence.

[0009] This invention aims at offering the record medium which recorded the updating program of the communication-mode software on the wireless terminal list which can update a signal-processing protocol and communication-mode software called a wireless interface efficiently, and its base station in view of the above-mentioned trouble.

[0010]

[Means for Solving the Problem] The wireless terminal of this invention is a wireless terminal which receives the radio signal ****(ed) from a base station by the communication mode specified by the software built in, and acquires information data from a base station. The 1st storage section the communication-mode software which specifies the communication mode when acquiring information data from a base station is remembered to be, Change to the communication-mode software memorized by the 1st storage section, and it has the 2nd storage section the standard communication-mode software which specifies the communication mode when acquiring the communication-mode software updated from the base station is remembered to be. this — Renewal of the communication-mode software memorized by said 1st storage section is faced. While acquiring the communication-mode software which received the radio signal ****(ed) from a base station by the standard communication-mode software memorized by said 2nd storage section, and was updated from the base station concerned It is characterized by carrying out the updating storage of the acquired communication-mode software concerned which was updated at said 1st storage section.

[0011] The renewal of the communication-mode software of the wireless terminal of this invention Do with the record medium which recorded the program for changing the communication-mode software of a wireless terminal by computer. This program is made to be changed to the standard communication-mode software to which the communication-mode software used until now [of a wireless terminal] is set beforehand in the case of renewal of the communication-mode software of a wireless terminal. Standard communication-mode software is made to receive the updating communication-mode software by which wireless transmission is carried out by standard communication-mode software from a base station, and it is characterized by making the received updating communication-mode software concerned changed to said standard communication-mode software.

[0012] Moreover, an analog-to-digital-conversion means by which the wireless terminal of this invention changes into a digital signal the analog signal received on radio, A recovery means to restore to the digital signal outputted from this analog-to-digital-conversion means by software processing, A processing software supply means to supply the software for recovery processing to this recovery means, A control signal supply means to supply the control signal for controlling the specification of each of said means of operation, The 1st memory section which memorizes communication-mode software including the software which said processing software supply means supplies, and the control signal which this control signal supply means supplies, It has the 2nd memory section which memorizes the standard communication-mode software for updating the communication-mode software memorized by the 1st memory section. this — In renewal of

the communication-mode software of said 1st memory section The updating storage of the standard communication-mode software memorized by said 1st memory section at said 2nd memory section is carried out. Wireless receives the communication-mode software updated by said analog-to-digital-conversion means and recovery means which operate through said processing software supply means and a control signal supply means with this standard communication-mode software. It is characterized by changing and memorizing the updated this communication-mode software in said 1st memory section at a standard communication mode. [0013] Furthermore, it is characterized by attaching the 3rd memory section by which archival memory of the communication-mode software which was being used at every renewal of the communication-mode software memorized by the 1st memory section concerned until now is serially carried out to said 1st memory section. Renewal of the communication-mode software memorized by said 1st memory section is faced further again. It judges whether it is the same as that of the wireless interface of the communication-mode software which the wireless interface of the communication-mode software updated was using until now. Only when not the same, the updating storage of the standard communication-mode software memorized by said 1st memory section at said 2nd memory section is carried out. Wireless receives the communication-mode software updated by said analog-to-digital-conversion means and recovery means which operate with this standard communication-mode software through said processing software supply means and a control signal supply means. It is characterized by changing and memorizing the updated this communication-mode software for standard communication-mode software at said 1st memory section.

[0014] On the other hand, the base station of the wireless terminal of this invention is characterized by having a transmitting means to transmit the communication-mode software of two or more different classes from the communication-mode software concerned of 1 for renewal of a wireless terminal with the communication-mode software of 1 defined beforehand at least.

[0015] Furthermore, in said transmitting means, communication-mode software of two or more classes is characterized by including the information on the latest version. Said transmitting means is characterized by having always transmitted the communication-mode software of two or more classes further again.

[0016]

[Embodiment of the Invention] Hereafter, the gestalt of suitable operation of this invention is explained to a detail, referring to an accompanying drawing. Drawing 1 is the signal schematic diagram of the receiving side of the wireless terminal T which makes a subject the communication link between highway and vehicle using the software wireless technique by the gestalt of 1 operation of this invention. The wireless terminal T is equipped with the antenna 1 for a communication link between highway and vehicle, and the antenna 1 is connected to the frequency changing circuit 2. A frequency changing circuit 2 carries out frequency conversion of the high frequency signal received with the antenna 1 to a baseband signaling band.

[0017] The output of a frequency changing circuit 2 is supplied to an analog-to-digital converter (an A/D converter is called hereafter) 4 through the filter 3 for removing undesired signals other than a baseband signaling band. A/D converter 4 has composition which samples the analog signal of the output of a filter 3, quantizes, and is changed into a digital signal.

[0018] The output of A/D converter 4 is connected to the demodulator circuit 5. In this demodulator circuit 5, a modulating signal is recovered from the output signal of A/D converter 4 by digital signal processing, and this recovery signal is supplied to information acquisition and an output unit 6. It operates outputting information acquisition and an output unit 6 to the mounted computer which outputs a part of the information data to a display device 7 based on the acquisition data, or does not illustrate the associated-data section in the data-acquisition processing and the list which change into information data the recovery signal supplied from a demodulator circuit 5 according to a predetermined protocol, and outputting to the memory which mentions the updating data division in the case of updating communication-mode software later further etc.

[0019] In addition, the signal processing is prescribed by software and the software for signal

processing is given for said demodulator circuit 5, information acquisition, and an output unit 6 from the software supply circuit 9. Moreover, a signal for each circuit of said frequency changing circuit 2, a filter 3, A/D converter 4, a demodulator circuit 5, information acquisition, and an output unit 6 to control the specification of operation, since a predetermined specification of operation is specified according to the protocol of each wireless interface and signal processing etc. is given by the control signal supply circuit 8.

[0020] What packed this software for signal processing (a wireless interface is included) and control signal (the protocol of signal processing is included) into one in the gestalt of this operation here is called communication-mode software. And by changing this communication-mode software, modification of the protocol of a wireless interface and signal processing etc. will be attained, and the wireless terminal T will correspond to two or more wireless interfaces and two or more protocols.

[0021] by the way, the gestalt of this operation — setting — communication-mode software — the memory means 10 of the wireless terminal T — each — memory section 10-1-4 memorize. The memory section 10-1 memorizes the communication-mode software which is carrying out current use, the memory section 10-2 memorizes standard communication-mode software, the memory section 10-3 memorizes two or more communication-mode software which the wireless terminal T holds, and the memory section 10-4 has the composition of memorizing the communication-mode software for updating sent from a base station U by information acquisition and the output unit 6.

[0022] And since the error remains or the data of the communication-mode software for updating which has passed the transmission system have possibility that the unjust processing by the third person is added, The memory section 10-4 is further connected also with a checking circuit 11. A checking circuit 11 Code data, error correcting code data, etc. which are contained in the communication-mode software for updating sent to the memory section 10-4 perform the check of a residual error and inaccurate existence etc.

[0023] Although the signal network of the receiving side of the wireless terminal T is constituted as mentioned above, and that each part has actuation controlled by the control means 12, for example, the ITS service person corresponding to two or more wireless interfaces and the protocol of signal processing updates a wireless interface, a signal-processing protocol, etc. according to maintenance and an advance of the advance of communication technology, ITS, and a road infrastructure, and this wireless terminal T also has the duty which supplies better service.

[0024] Drawing 2 is drawing showing a part of signal network configuration of a base station U to the wireless terminal T mentioned above. The information generator 21 which supplies the provided information to the wireless terminals T, such as ITS service information, and the updating data generator 22 which supplies the version information etc. to the communication-mode software list for updating are connected to multiplexer 23. Multiplexer 23 multiplexes the information data from the information generator 21 and an updating data generator, and the multiplexed information data is transmitted towards the wireless terminal T through an amplifying circuit 24 from an antenna 25.

[0025] Drawing 3 and drawing 4 are flow charts which show the processing configuration of updating procedures, such as a protocol of the wireless interface in the wireless terminal T, and signal processing. In addition, B method and standard communication-mode software are temporarily explained for communication-mode software just before the wireless terminal T was using it as a C method. That is, the communication-mode software of C method shall be memorized by the memory section 10-2 which the communication-mode software of B method is memorized by the memory section 10-1 which memorizes the communication-mode software which is carrying out current use, and memorizes standard communication-mode software in it.

[0026] Suppose that there was hope of updating of communication-mode software from a base station U in this situation now (step S1). From this base station U, when the hope concerned to the wireless terminal T relates to modification of a wireless interface, this hope is transmitted to the wireless terminal T by the communication-mode software of C method irrespective of the communication-mode software (namely, B method) which was being used between the base

station U and the wireless terminal T until now.

[0027] On the other hand, if the hope concerned to the wireless terminal T does not need modification of a wireless interface from this base station U but it is related with modification of the protocol of signal processing, this hope will be transmitted to the wireless terminal T by the communication-mode software of the same B method as having used it until now. And whether the wireless terminal T which received the hope of updating of a communication mode from the base station U being the same as that of the wireless interface which the wireless interface first updated from a base station U was using until now, and the update process which checks, is with the case where it differs, and the case of being the same, and is different are performed (step S2).

[0028] Drawing 3 is a flow chart which shows processing in case drawing 4 uses the same wireless interface for the processing in the case of using a different wireless interface. First, when using a different wireless interface, as shown in drawing 3, the version of the communication-mode software of B method which was operating in the memory section 10-1 is compared with the version of the communication-mode software of B method currently stored in the memory section 10-3 from before, and the latest version is saved in the predetermined area of the memory section 10-3 (step S3).

[0029] Subsequently, C method which is standard communication-mode software is loaded to the memory section 10-1 from the memory section 10-2 (step S4). By this, the wireless terminal T will operate with the communication-mode software of the criterion of C method instead of the communication-mode software of B method after this.

[0030] That is, the specification of C method of operation will be prescribed as a protocol of each wireless interface and signal processing by the signal by which a frequency changing circuit 2, a filter 3, A/D converter 4, a demodulator circuit 5, information acquisition, and the specification of each circuit of an output unit 6 of operation are also given from the control signal supply circuit 8. Therefore, as for a demodulator circuit 5, information acquisition, and the software for signal processing of an output unit 6, the software for signal processing of C method comes to be given from the software supply circuit 9.

[0031] By this, since it is decided beforehand that the communication-mode software for updating is transmitted to the wireless terminal T from a base station U by C method, between a base station U and the wireless terminal T Communication-mode software can incorporate [the latest version of various communication-mode software] in the memory section 10-4 through each circuits 2-6 by the communication-mode software of C method in accordance with mutual with C method (step S5).

[0032] For example, in this condition, when the communication-mode software of F method is acquired with information acquisition and an output unit 6, the communication-mode software of F method will be memorized by the memory section 10-4. Here, in order that F method of the communication-mode software memorized by this memory section 10-4 may confirm whether to be what has been transmitted normally, a checking circuit 11 operates (step S6). A checking circuit 11 confirms whether the error remains or not using an error correction technique to the data of communication-mode software, and removes an error while it confirms whether to be that by which communication-mode software is corrected unjustly using a code technique etc. And when not passing this check, again, the communication-mode acquisition software of F method is acquired, and processing is repeated (steps S5 and S6).

[0033] Then, when the communication-mode software of normal F method is obtained by the memory section 10-4, it loads to the memory section 10-1 from the memory section 10-4 (step S7). By this, the wireless terminal T will operate as a wireless terminal of the communication-mode software of F method. Therefore, first, by actuation of the origination side which is not illustrated, the wireless terminal T requires of the base station U of the communication-mode software of F method, and receives the test signal at the time of updating so that the test signal of the communication-mode software of F method may be transmitted.

[0034] When the wireless terminal T receives the test signal of the communication-mode software of F method from a base station U, the wireless terminal T will be transmitted to the mounted computer which does not illustrate the associated data section through information

acquisition and output unit 6 grade, and will be again checked by mounted computer (step S8). And if the result of this check is O.K., ITS service will be received using the software of updated F method (step S9).

[0035] On the other hand, if the result of this check shows abnormalities, according to a test result, communication-mode software of updated F method is changed (step S10), and after modification, it tests again by loading the communication-mode software of that F method to the memory section 10-1 (step S7) (step S 8 ten), and normalizes again. By the way, modification of a wireless interface is not needed at said step S2 using the same wireless interface, but Seki, then when it is checked, the wireless terminal T carries out processing as shown at drawing 4 to modification of the protocol of signal processing.

[0036] Namely, since a wireless interface is changeless, changing the contents of the memory section 10-1 is not continued, The communication-mode software of Bv method as version up of B method of communication-mode software is acquired in the memory section 10-4 with information acquisition and an output unit 6 (step S11). By the checking circuit 11 The same processing as step S5 of drawing 3 mentioned above is performed, and the contents of the communication-mode software of acquired Bv method are inspected (step S12). When Bv method of normal communication-mode software is obtained by this, after saving the communication-mode software of B method memorized by the memory section 10-1 in the memory section 10-3 (step S13), the contents of the memory section 10-4 are loaded to the memory section 10-1 (step S14), and the wireless terminal T is operated by the communication-mode software of Bv method.

[0037] Furthermore, it is confirmed whether request like step S8-10 of drawing 3 mentioned above to transmit the test signal of Bv method of communication-mode software from a base station U, receive the test signal, and Bv method of communication-mode software operates normally (step S15). And if the result of this check shows abnormalities while ITS service will be received using the software of updated Bv method (step S16), if the result of this check is O.K. According to a test result, communication-mode software of updated F method is changed (step S17), and after modification, again, it tests again by loading the communication-mode software of the F method to the memory section 10-1 (step S14) (step S 15 17), and normalizes.

[0038] Especially drawing 5 is a flow chart which shows the processing which updates communication-mode software automatically, as a user does not need to take care about updating. It is carried out by setting up in this renewal of automatic, so that the wireless terminal T may be beforehand operated for every predetermined time interval, for example, *****, as a wireless terminal T of the communication-mode software of C method which is a standard method.

[0039] And the version of the communication-mode software of for example, B method memorized by the memory section 10-1 until now when the wireless terminal T became this setting time of day, The version of the communication-mode software of B method currently stored in the memory section 10-3 from before is compared. The latest version is saved in the predetermined area of the memory section 10-3 (step S21), and C method which is standard communication-mode software is loaded to the memory section 10-1 from the memory section 10-2 (step S22).

[0040] It requires that the value of the latest version of the communication-mode software of 1 should be transmitted according to the sequence defined beforehand about two or more communication-mode software currently stored in the memory section 10-3 from before to the base station U by C method whose wireless terminal T is moreover standard communication-mode software, and the value of the latest version of the communication-mode software of 1 concerned is acquired from a base station U. The value of the version of two or more communication-mode software which the wireless terminal T memorized by this acquired value and the memory section 10-3 holds is compared, and the version of each communication-mode software memorized by the memory section 10-3 confirms whether be the newest thing (step S23).

[0041] When it is checked by said check that it is the communication-mode software which is not the newest version, and the wireless terminal T processes steps S5-S8 of drawing 3 which

required and mentioned above transmission of the latest version of the communication-mode software concerned to the base station U, and drawing 4 , the latest version of the communication-mode software concerned is gained in the memory section 10-3 (step S24).

[0042] And if it checks that all communication-mode software is the latest versions (step S25) and this is able to be checked about two or more communication-mode software currently stored in the memory section 10-3 from before, while ending an automatic update process, when the communication-mode software which is not checked yet remains, processing of the above-mentioned step S23 - step S25 is repeated, and is performed.

[0043] As mentioned above, although the wireless terminal of this invention and the gestalt of operation of the base station were explained, this invention is not limited to the gestalt of the above-mentioned implementation. By for example, the case where there is no modification in a wireless interface and other signal-processing protocols are updated with the gestalt of the operation which gave [above-mentioned] explanation Although it was made to differ from the processing which shows the processing in the case of being updated by Bv method with which communication-mode software was upgraded from B method to drawing 4 , and shows it to drawing 3 in the case of being subject to change to a wireless interface Also by processing naturally shown in drawing 3 , processing of the step [in / modification of the communication-mode software from B method to Bv method is possible, and / drawing 3 and drawing 4] S2 and step S11 - step S16 can be deleted.

[0044] Moreover, so that a test signal may be transmitted in step S8 of drawing 3 by F method to update In 22 and 23 the base station of the transmitting method software of F method — requiring — moreover, the step S of drawing 5 — Although he is trying to require that the value of the latest version should be transmitted to the base station of the transmitting method software of C method about two or more communication-mode software currently stored in the memory section 10-3 from before When it is this test signal and the configuration that a base station always transmits latest version information, even if it does not carry out such [naturally] a demand from a wireless terminal side, it cannot be overemphasized are a test signal and that latest version information is acquirable.

[0045] furthermore , although the base station be explain to the wireless terminal list center on ITS service at an example , apply a software wireless technique to a versatility wireless system , and restrict the updating approach of the transmitting method software mention above to an ITS -related wireless system with the gestalt of the operation operation give [above-mentioned] explanation with the improvement in an engine performance of the circuit scale containing an antenna , an A/D converter , and memory and a circuit working speed .

[0046] Moreover, this invention may be a record medium which recorded the program for operating a computer as the above-mentioned wireless terminal and in which computer reading is possible, for example, may be what type of a magnetic tape, CD-ROM, an IC card, a RAM card, etc. of record medium.

[0047]

[Effect of the Invention] As mentioned above, according to this invention, in order to update communication-mode software by the standard communication-mode software of 1, it becomes the updating procedure independent of the communication-mode software which was being used before updating. Therefore, since updating procedure can be unified by the standard communication-mode software of 1, efficient measures can be taken also against unjust prevention and it becomes saving of the cost to the information infrastructure. Furthermore, since updating procedure is easy, it means that service is upgradable timely by the service provider side, and a big merit is given to a user in a telecommunications service [as / in the ITS service which are insurance and comfortable *****]. And according to this invention, the updating procedure of a wireless interface or a signal-processing protocol in a wireless terminal is established, and the effectiveness of a wireless terminal can fully be demonstrated.

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TECHNICAL FIELD

[Field of the Invention] This invention relates to renewal of communication-mode software, such as a wireless interface, in the wireless terminal which used the software wireless technique, and its base station.

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PRIOR ART

[Description of the Prior Art] By performing the communication link between highway and vehicle with the wireless beacon and the mounted terminal which were installed in some places of the side strip of a road as an intelligent transport system (ITS being called Intelligent Transport System and the following), the road traffic information transmitted from a wireless beacon is received, and the system which displays the duration to path guidance or a destination on a mounted terminal screen, and the electronic toll collection system for tariff accounting in a highway are being put in practical use. Moreover, the system which realizes much more safety operation is also considered by performing the communication link between cars further from now on.

[0003] Thus, the wireless terminal used for these systems is adapted to the system of varieties as the system of varieties is proposed, even if it mentions ITS as an example. Moreover, since it has possibility of upgrading each [these] system every 2 or 3 years, the wireless terminal used for these systems is adapted also to this version up with rapid development of communication technology. In response to these situations, the wireless terminal using the software wireless technique as a wireless technique in which installation, the existing system use modification, etc. of a new system can be flexibly coped with as a wireless terminal used for these systems attracts attention.

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EFFECT OF THE INVENTION

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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] At the wireless terminal using this software wireless technique, required radio-signal processing is described by software and radio-signal processing is performed according to this software. Therefore, in order to update the radio-signal processing, what is necessary will be just to update the software corresponding to it.

[0005] In this case, since the software corresponding to radio-signal processing is stored in the memory built in the wireless terminal or the base station, it is carried out by rewriting the contents of storage of this memory. There is a method of transmitting the software concerned to the memory of a wireless terminal from IC memory card which, for example, made the software of new radio-signal processing memorize as one of the approach of this of rewriting. However, this approach has the trouble that it is necessary to prepare IC memory card for every renewal of software.

[0006] Moreover, since the intention to want to make the correspondence procedure and wireless interface updated in the above-mentioned ITS service is an intention by the side of service, a user is expected the approach to which a burden is not applied as much as possible. Therefore, the establishment of a method which a service provider transmits [establishment] the updating data of the software corresponding to radio-signal processing to a user's wireless terminal by wireless through a base station, and makes the correspondence procedure and wireless interface of ITS service in the wireless terminal concerned update is required.

[0007] Then, if it is going to transmit updating data to a wireless terminal by wireless from a base station, the technical problem whether transmitting using which radio system is suitable will occur first. Furthermore, the radio method of a user's wireless terminal changes also with used services. For example, if a lot of updating data are transmitted by this communication mode when the communication mode with a low transfer rate has received service, the long transfer time will be taken and it will become what has the bad user-friendliness for a user. On the other hand, when the service which a user can transmit at high speed is being used, that service may be a charge, and since a tariff occurs for updating, the problem who pays this tariff is also generated in this case.

[0008] In the radio method in which the user is doing current use on the other hand, a wireless interface remains as it is, and it is necessary to establish the updating method based on the situation when updating to want to change into another radio method of still more nearly another service, and to communicate with the latest version of the radio method to update a signal-processing protocol, namely, perform modification and updating to coincidence.

[0009] This invention aims at offering the record medium which recorded the updating program of the communication-mode software on the wireless terminal list which can update a signal-processing protocol and communication-mode software called a wireless interface efficiently, and its base station in view of the above-mentioned trouble.

[Translation done.]

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- 1.This document has been translated by computer. So the translation may not reflect the original precisely.
- 2.**** shows the word which can not be translated.
- 3.In the drawings, any words are not translated.

MEANS

[Means for Solving the Problem] The wireless terminal of this invention is a wireless terminal which receives the radio signal *****(ed) from a base station by the communication mode specified by the software built in, and acquires information data from a base station. The 1st storage section the communication-mode software which specifies the communication mode when acquiring information data from a base station is remembered to be, Change to the communication-mode software memorized by the 1st storage section, and it has the 2nd storage section the standard communication-mode software which specifies the communication mode when acquiring the communication-mode software updated from the base station is remembered to be. this — Renewal of the communication-mode software memorized by said 1st storage section is faced. While acquiring the communication-mode software which received the radio signal *****(ed) from a base station by the standard communication-mode software memorized by said 2nd storage section, and was updated from the base station concerned It is characterized by carrying out the updating storage of the acquired communication-mode software concerned which was updated at said 1st storage section.

[0011] The renewal of the communication-mode software of the wireless terminal of this invention Do with the record medium which recorded the program for changing the communication-mode software of a wireless terminal by computer. This program is made to be changed to the standard communication-mode software to which the communication-mode software used until now [of a wireless terminal] is set beforehand in the case of renewal of the communication-mode software of a wireless terminal. Standard communication-mode software is made to receive the updating communication-mode software by which wireless transmission is carried out by standard communication-mode software from a base station, and it is characterized by making the received updating communication-mode software concerned changed to said standard communication-mode software.

[0012] Moreover, an analog-to-digital-conversion means by which the wireless terminal of this invention changes into a digital signal the analog signal received on radio, A recovery means to restore to the digital signal outputted from this analog-to-digital-conversion means by software processing, A processing software supply means to supply the software for recovery processing to this recovery means, A control signal supply means to supply the control signal for controlling the specification of each of said means of operation, The 1st memory section which memorizes communication-mode software including the software which said processing software supply means supplies, and the control signal which this control signal supply means supplies, It has the 2nd memory section which memorizes the standard communication-mode software for updating the communication-mode software memorized by the 1st memory section. this — In renewal of the communication-mode software of said 1st memory section The updating storage of the standard communication-mode software memorized by said 1st memory section at said 2nd memory section is carried out. Wireless receives the communication-mode software updated by said analog-to-digital-conversion means and recovery means which operate through said processing software supply means and a control signal supply means with this standard communication-mode software. It is characterized by changing and memorizing the updated this communication-mode software in said 1st memory section at a standard communication mode.

[0013] Furthermore, it is characterized by attaching the 3rd memory section by which archival memory of the communication-mode software which was being used at every renewal of the communication-mode software memorized by the 1st memory section concerned until now is serially carried out to said 1st memory section. Renewal of the communication-mode software memorized by said 1st memory section is faced further again. It judges whether it is the same as that of the wireless interface of the communication-mode software which the wireless interface of the communication-mode software updated was using until now. Only when not the same, the updating storage of the standard communication-mode software memorized by said 1st memory section at said 2nd memory section is carried out. Wireless receives the communication-mode software updated by said analog-to-digital-conversion means and recovery means which operate with this standard communication-mode software through said processing software supply means and a control signal supply means. It is characterized by changing and memorizing the updated this communication-mode software for standard communication-mode software at said 1st memory section.

[0014] On the other hand, the base station of the wireless terminal of this invention is characterized by having a transmitting means to transmit the communication-mode software of two or more different classes from the communication-mode software concerned of 1 for renewal of a wireless terminal with the communication-mode software of 1 defined beforehand at least.

[0015] Furthermore, in said transmitting means, communication-mode software of two or more classes is characterized by including the information on the latest version. Said transmitting means is characterized by having always transmitted the communication-mode software of two or more classes further again.

[0016]

[Embodiment of the Invention] Hereafter, the gestalt of suitable operation of this invention is explained to a detail, referring to an accompanying drawing. Drawing 1 is the signal schematic diagram of the receiving side of the wireless terminal T which makes a subject the communication link between highway and vehicle using the software wireless technique by the gestalt of 1 operation of this invention. The wireless terminal T is equipped with the antenna 1 for a communication link between highway and vehicle, and the antenna 1 is connected to the frequency changing circuit 2. A frequency changing circuit 2 carries out frequency conversion of the high frequency signal received with the antenna 1 to a baseband signaling band.

[0017] The output of a frequency changing circuit 2 is supplied to an analog-to-digital converter (an A/D converter is called hereafter) 4 through the filter 3 for removing undesired signals other than a baseband signaling band. A/D converter 4 has composition which samples the analog signal of the output of a filter 3, quantizes, and is changed into a digital signal.

[0018] The output of A/D converter 4 is connected to the demodulator circuit 5. In this demodulator circuit 5, a modulating signal is recovered from the output signal of A/D converter 4 by digital signal processing, and this recovery signal is supplied to information acquisition and an output unit 6. It operates outputting information acquisition and an output unit 6 to the mounted computer which outputs a part of the information data to a display device 7 based on the acquisition data, or does not illustrate the associated-data section in the data-acquisition processing and the list which change into information data the recovery signal supplied from a demodulator circuit 5 according to a predetermined protocol, and outputting to the memory which mentions the updating data division in the case of updating communication-mode software later further etc.

[0019] In addition, the signal processing is prescribed by software and the software for signal processing is given for said demodulator circuit 5, information acquisition, and an output unit 6 from the software supply circuit 9. Moreover, a signal for each circuit of said frequency changing circuit 2, a filter 3, A/D converter 4, a demodulator circuit 5, information acquisition, and an output unit 6 to control the specification of operation, since a predetermined specification of operation is specified according to the protocol of each wireless interface and signal processing etc. is given by the control signal supply circuit 8.

[0020] What packed this software for signal processing (a wireless interface is included) and

control signal (the protocol of signal processing is included) into one in the gestalt of this operation here is called communication-mode software. And by changing this communication-mode software, modification of the protocol of a wireless interface and signal processing etc. will be attained, and the wireless terminal T will correspond to two or more wireless interfaces and two or more protocols.

[0021] by the way, the gestalt of this operation — setting — communication-mode software — the memory means 10 of the wireless terminal T — each — memory section 10-1-4 memorize. The memory section 10-1 memorizes the communication-mode software which is carrying out current use, the memory section 10-2 memorizes standard communication-mode software, the memory section 10-3 memorizes two or more communication-mode software which the wireless terminal T holds, and the memory section 10-4 has the composition of memorizing the communication-mode software for updating sent from a base station U by information acquisition and the output unit 6.

[0022] And since the error remains or the data of the communication-mode software for updating which has passed the transmission system have possibility that the unjust processing by the third person is added, The memory section 10-4 is further connected also with a checking circuit 11. A checking circuit 11 Code data, error correcting code data, etc. which are contained in the communication-mode software for updating sent to the memory section 10-4 perform the check of a residual error and inaccurate existence etc.

[0023] Although the signal network of the receiving side of the wireless terminal T is constituted as mentioned above, and that each part has actuation controlled by the control means 12, for example, the ITS service person corresponding to two or more wireless interfaces and the protocol of signal processing updates a wireless interface, a signal-processing protocol, etc. according to maintenance and an advance of the advance of communication technology, ITS, and a road infrastructure, and this wireless terminal T also has the duty which supplies better service.

[0024] Drawing 2 is drawing showing a part of signal network configuration of a base station U to the wireless terminal T mentioned above. The information generator 21 which supplies the provided information to the wireless terminals T, such as ITS service information, and the updating data generator 22 which supplies the version information etc. to the communication-mode software list for updating are connected to multiplexer 23. Multiplexer 23 multiplexes the information data from the information generator 21 and an updating data generator, and the multiplexed information data is transmitted towards the wireless terminal T through an amplifying circuit 24 from an antenna 25.

[0025] Drawing 3 and drawing 4 are flow charts which show the processing configuration of updating procedures, such as a protocol of the wireless interface in the wireless terminal T, and signal processing. In addition, B method and standard communication-mode software are temporarily explained for communication-mode software just before the wireless terminal T was using it as a C method. That is, the communication-mode software of C method shall be memorized by the memory section 10-2 which the communication-mode software of B method is memorized by the memory section 10-1 which memorizes the communication-mode software which is carrying out current use, and memorizes standard communication-mode software in it.

[0026] Suppose that there was hope of updating of communication-mode software from a base station U in this situation now (step S1). From this base station U, when the hope concerned to the wireless terminal T relates to modification of a wireless interface, this hope is transmitted to the wireless terminal T by the communication-mode software of C method irrespective of the communication-mode software (namely, B method) which was being used between the base station U and the wireless terminal T until now.

[0027] On the other hand, if the hope concerned to the wireless terminal T does not need modification of a wireless interface from this base station U but it is related with modification of the protocol of signal processing, this hope will be transmitted to the wireless terminal T by the communication-mode software of the same B method as having used it until now. And whether the wireless terminal T which received the hope of updating of a communication mode from the base station U being the same as that of the wireless interface which the wireless interface first

updated from a base station U was using until now, and the update process which checks, is with the case where it differs, and the case of being the same, and is different are performed (step S2).

[0028] Drawing 3 is a flow chart which shows processing in case drawing 4 uses the same wireless interface for the processing in the case of using a different wireless interface. First, when using a different wireless interface, as shown in drawing 3, the version of the communication-mode software of B method which was operating in the memory section 10-1 is compared with the version of the communication-mode software of B method currently stored in the memory section 10-3 from before, and the latest version is saved in the predetermined area of the memory section 10-3 (step S3).

[0029] Subsequently, C method which is standard communication-mode software is loaded to the memory section 10-1 from the memory section 10-2 (step S4). By this, the wireless terminal T will operate with the communication-mode software of the criterion of C method instead of the communication-mode software of B method after this.

[0030] That is, the specification of C method of operation will be prescribed as a protocol of each wireless interface and signal processing by the signal by which a frequency changing circuit 2, a filter 3, A/D converter 4, a demodulator circuit 5, information acquisition, and the specification of each circuit of an output unit 6 of operation are also given from the control signal supply circuit 8. Therefore, as for a demodulator circuit 5, information acquisition, and the software for signal processing of an output unit 6, the software for signal processing of C method comes to be given from the software supply circuit 9.

[0031] By this, since it is decided beforehand that the communication-mode software for updating is transmitted to the wireless terminal T from a base station U by C method, between a base station U and the wireless terminal T Communication-mode software can incorporate [the latest version of various communication-mode software] in the memory section 10-4 through each circuits 2-6 by the communication-mode software of C method in accordance with mutual with C method (step S5).

[0032] For example, in this condition, when the communication-mode software of F method is acquired with information acquisition and an output unit 6, the communication-mode software of F method will be memorized by the memory section 10-4. Here, in order that F method of the communication-mode software memorized by this memory section 10-4 may confirm whether to be what has been transmitted normally, a checking circuit 11 operates (step S6). A checking circuit 11 confirms whether the error remains or not using an error correction technique to the data of communication-mode software, and removes an error while it confirms whether to be that by which communication-mode software is corrected unjustly using a code technique etc. And when not passing this check, again, the communication-mode acquisition software of F method is acquired, and processing is repeated (steps S5 and S6).

[0033] Then, when the communication-mode software of normal F method is obtained by the memory section 10-4, it loads to the memory section 10-1 from the memory section 10-4 (step S7). By this, the wireless terminal T will operate as a wireless terminal of the communication-mode software of F method. Therefore, first, by actuation of the origination side which is not illustrated, the wireless terminal T requires of the base station U of the communication-mode software of F method, and receives the test signal at the time of updating so that the test signal of the communication-mode software of F method may be transmitted.

[0034] When the wireless terminal T receives the test signal of the communication-mode software of F method from a base station U, the wireless terminal T will be transmitted to the mounted computer which does not illustrate the associated data section through information acquisition and output unit 6 grade, and will be again checked by mounted computer (step S8). And if the result of this check is O.K., ITS service will be received using the software of updated F method (step S9).

[0035] On the other hand, if the result of this check shows abnormalities, according to a test result, communication-mode software of updated F method is changed (step S10), and after modification, it tests again by loading the communication-mode software of that F method to the memory section 10-1 (step S7) (step S 8 ten), and normalizes again. By the way, modification of

a wireless interface is not needed at said step S2 using the same wireless interface, but Seki, then when it is checked, the wireless terminal T carries out processing as shown at drawing 4 to modification of the protocol of signal processing.

[0036] Namely, since a wireless interface is changeless, changing the contents of the memory section 10-1 is not continued, The communication-mode software of Bv method as version up of B method of communication-mode software is acquired in the memory section 10-4 with information acquisition and an output unit 6 (step S11). By the checking circuit 11 The same processing as step S5 of drawing 3 mentioned above is performed, and the contents of the communication-mode software of acquired Bv method are inspected (step S12). When Bv method of normal communication-mode software is obtained by this, after saving the communication-mode software of B method memorized by the memory section 10-1 in the memory section 10-3 (step S13), the contents of the memory section 10-4 are loaded to the memory section 10-1 (step S14), and the wireless terminal T is operated by the communication-mode software of Bv method.

[0037] Furthermore, it is confirmed whether request like step S8-10 of drawing 3 mentioned above to transmit the test signal of Bv method of communication-mode software from a base station U, receive the test signal, and Bv method of communication-mode software operates normally (step S15). And if the result of this check shows abnormalities while ITS service will be received using the software of updated Bv method (step S16), if the result of this check is O.K. According to a test result, communication-mode software of updated F method is changed (step S17), and after modification, again, it tests again by loading the communication-mode software of the F method to the memory section 10-1 (step S14) (step S15 17), and normalizes.

[0038] Especially drawing 5 is a flow chart which shows the processing which updates communication-mode software automatically, as a user does not need to take care about updating. It is carried out by setting up in this renewal of automatic, so that the wireless terminal T may be beforehand operated for every predetermined time interval, for example, *****, as a wireless terminal T of the communication-mode software of C method which is a standard method.

[0039] And the version of the communication-mode software of for example, B method memorized by the memory section 10-1 until now when the wireless terminal T became this setting time of day, The version of the communication-mode software of B method currently stored in the memory section 10-3 from before is compared. The latest version is saved in the predetermined area of the memory section 10-3 (step S21), and C method which is standard communication-mode software is loaded to the memory section 10-1 from the memory section 10-2 (step S22).

[0040] It requires that the value of the latest version of the communication-mode software of 1 should be transmitted according to the sequence defined beforehand about two or more communication-mode software currently stored in the memory section 10-3 from before to the base station U by C method whose wireless terminal T is moreover standard communication-mode software, and the value of the latest version of the communication-mode software of 1 concerned is acquired from a base station U. The value of the version of two or more communication-mode software which the wireless terminal T memorized by this acquired value and the memory section 10-3 holds is compared, and the version of each communication-mode software memorized by the memory section 10-3 confirms whether be the newest thing (step S23).

[0041] When it is checked by said check that it is the communication-mode software which is not the newest version, and the wireless terminal T processes steps S5-S8 of drawing 3 which required and mentioned above transmission of the latest version of the communication-mode software concerned to the base station U, and drawing 4, the latest version of the communication-mode software concerned is gained in the memory section 10-3 (step S24).

[0042] And if it checks that all communication-mode software is the latest versions (step S25) and this is able to be checked about two or more communication-mode software currently stored in the memory section 10-3 from before, while ending an automatic update process, when the communication-mode software which is not checked yet remains, processing of the above-

mentioned step S23 – step S25 is repeated, and is performed.

[0043] As mentioned above, although the wireless terminal of this invention and the gestalt of operation of the base station were explained, this invention is not limited to the gestalt of the above-mentioned implementation. By for example, the case where there is no modification in a wireless interface and other signal-processing protocols are updated with the gestalt of the operation which gave [above-mentioned] explanation Although it was made to differ from the processing which shows the processing in the case of being updated by Bv method with which communication-mode software was upgraded from B method to drawing 4 , and shows it to drawing 3 in the case of being subject to change to a wireless interface Also by processing naturally shown in drawing 3 , processing of the step [in / modification of the communication-mode software from B method to Bv method is possible, and / drawing 3 and drawing 4] S2 and step S11 – step S16 can be deleted.

[0044] Moreover, so that a test signal may be transmitted in step S8 of drawing 3 by F method to update In 22 and 23 the base station of the transmitting method software of F method — requiring — moreover, the step S of drawing 5 — Although he is trying to require that the value of the latest version should be transmitted to the base station of the transmitting method software of C method about two or more communication-mode software currently stored in the memory section 10-3 from before When it is this test signal and the configuration that a base station always transmits latest version information, even if it does not carry out such [naturally] a demand from a wireless terminal side, it cannot be overemphasized are a test signal and that latest version information is acquirable.

[0045] furthermore , although the base station be explain to the wireless terminal list center on ITS service at an example , apply a software wireless technique to a versatility wireless system , and restrict the updating approach of the transmitting method software mention above to an ITS -related wireless system with the gestalt of the operation give [above-mentioned] explanation of operation with the improvement in an engine performance of the circuit scale containing an antenna , an A/D converter , and memory and a circuit working speed .

[0046] Moreover, this invention may be a record medium which recorded the program for operating a computer as the above-mentioned wireless terminal and in which computer reading is possible, for example, may be what type of a magnetic tape, CD-ROM, an IC card, a RAM card, etc. of record medium.

[Translation done.]

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] It is the signal schematic diagram of the receiving side of the wireless terminal T which makes a subject the communication link between highway and vehicle using the software wireless technique by the gestalt of 1 operation of this invention.

[Drawing 2] It is drawing showing a part of signal network configuration of a base station U to the wireless terminal T.

[Drawing 3] It is the flow chart which shows the processing configuration of updating procedures, such as a protocol of the wireless interface in the wireless terminal T, and signal processing.

[Drawing 4] It is the flow chart which shows the processing configuration of updating procedures, such as a protocol of signal processing when not changing the wireless interface in the wireless terminal T.

[Drawing 5] It is the flow chart which showed the processing which updates communication-mode software automatically.

[Description of Notations]

T Wireless terminal

U Base station

1 Antenna

2 Frequency Changing Circuit (Frequency-Conversion Means)

4 Analog-to-digital Converter (Analog-to-digital-Conversion Means)

5 Demodulator Circuit (Recovery Means)

6 Information Acquisition and Output Unit

8 Control Signal Supply Circuit (Control Signal Supply Means)

9 Software Supply Circuit (Processing Software Supply Means)

10 Memory Means

10-1 Memory Section (1st Storage Section, 1st Memory Section)

10-2 Memory Section (2nd Storage Section, 2nd Memory Section)

10-3 Memory Section (3rd Memory Section)

11 Checking Circuit (Check Means)

[Translation done.]

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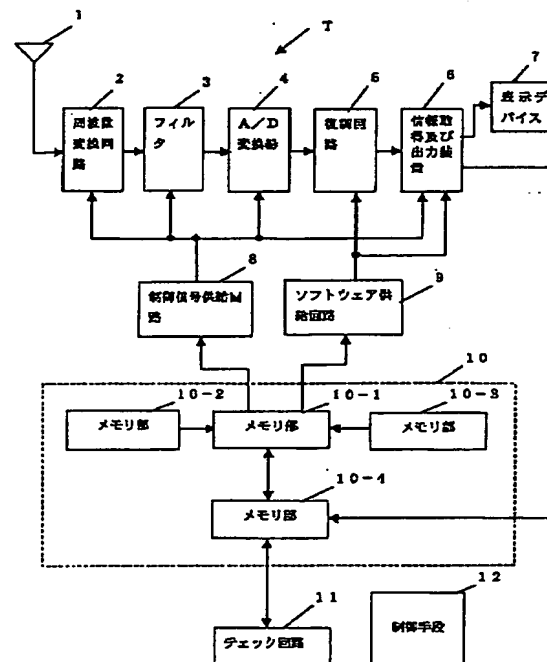
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(54) 【発明の名称】 無線端末並びにその通信方式ソフトウェアの更新プログラムを記録した記録媒体及びその基地局

(57) 【要約】

【課題】 信号処理プロトコルや無線インタフェースといった通信方式ソフトウェアの更新を効率よく行うことができる無線端末並びにその通信方式ソフトウェアの更新プログラムを記録した記録媒体、及びその基地局を提供する。

【解決手段】 通信方式ソフトウェアの更新に当たっては、この通信方式ソフトウェアに替えて標準通信方式ソフトウェアが制御信号供給回路 8 及びソフトウェア供給回路 9 に供給され、この標準通信方式ソフトウェアによって作動されるアナログディジタル変換器 4 及び復調回路 5 によって、更新される通信方式ソフトウェアをアンテナ 1 を介して受信し、メモリ手段 10 に記憶する。



【特許請求の範囲】

【請求項 1】 内蔵されるソフトウェアによって規定される通信方式で基地局から発せされる無線信号を受信して基地局から情報データを取得する無線端末であって、基地局から情報データを取得するときの通信方式を規定する通信方式ソフトウェアが記憶されている第 1 の記憶部と、該第 1 の記憶部に記憶されている通信方式ソフトウェアに替え、基地局から更新された通信方式ソフトウェアを取得するときの通信方式を規定する標準通信方式ソフトウェアが記憶されている第 2 の記憶部とを有し、前記第 1 の記憶部に記憶されている通信方式ソフトウェアの更新に際し、基地局から発せされる無線信号を前記第 2 の記憶部に記憶されている標準通信方式ソフトウェアで受信して当該基地局から更新された通信方式ソフトウェアを取得するとともに、当該取得した更新された通信方式ソフトウェアを前記第 1 の記憶部に更新記憶することを特徴とする無線端末。

【請求項 2】 コンピュータによって無線端末の通信方式ソフトウェアを変更するためのプログラムを記録した記録媒体であって、該プログラムは無線端末の通信方式ソフトウェアの更新の際、無線端末の今まで使用されていた通信方式ソフトウェアを予め定められている標準通信方式ソフトウェアに替えさせ、基地局から標準通信方式ソフトウェアで無線送信される更新通信方式ソフトウェアを標準通信方式ソフトウェアで受信させ、当該受信した更新通信方式ソフトウェアを前記標準通信方式ソフトウェアに替えさせることを特徴とする無線端末の通信方式ソフトウェアの更新プログラムを記録したコンピュータ読み取り可能な記録媒体。

【請求項 3】 無線で受信されるアナログ信号をデジタル信号に変換するアナログデジタル変換手段と、該アナログデジタル変換手段から出力されるデジタル信号をソフトウェア処理によって復調する復調手段と、該復調手段に復調処理のためのソフトウェアを供給する処理ソフトウェア供給手段と、前記各手段の動作仕様を制御するための制御信号を供給する制御信号供給手段と、前記処理ソフトウェア供給手段が供給するソフトウェアと該制御信号供給手段が供給する制御信号とを含めた通信方式ソフトウェアを記憶する第 1 のメモリ部と、該第 1 のメモリ部に記憶されている通信方式ソフトウェアを更新するための標準通信方式ソフトウェアを記憶する第 2 のメモリ部とを備え、前記第 1 のメモリ部の通信方式ソフトウェアの更新に当たっては、前記第 1 のメモリ部に前記第 2 のメモリ部に記憶されている標準通信方式ソフトウェアを更新記憶し、該標準通信方式ソフトウェアによって前記処理ソフトウェア供給手段及び制御信号供給手段を介して作動される前記アナログデジタル変換手段及び復調手段によって更新された通信方式ソフトウェアを無線によって受信し、該更新された通信方式ソフトウェアを前記第 1 のメモリ部に標準通信方式ソフ

トウェアに替えて記憶することを特徴とする無線端末。

【請求項 4】 前記第 1 のメモリ部には、当該第 1 のメモリ部に記憶されている通信方式ソフトウェアの更新の度に、今まで使用していた通信方式ソフトウェアが逐次保存記憶される第 3 のメモリ部が付設されていることを特徴とする請求項 3 記載の無線端末。

【請求項 5】 前記第 1 のメモリ部に記憶されている通信方式ソフトウェアの更新に際しては、更新される通信方式ソフトウェアの無線インタフェースが今まで使用していた通信方式ソフトウェアの無線インタフェースと同一か否かを判定し、同一でない場合にのみ、前記第 1 のメモリ部に前記第 2 のメモリ部に記憶されている標準通信方式ソフトウェアを更新記憶し、前記処理ソフトウェア供給手段及び制御信号供給手段を介して該標準通信方式ソフトウェアによって作動される前記アナログデジタル変換手段及び復調手段によって更新された通信方式ソフトウェアを無線によって受信し、該更新された通信方式ソフトウェアを前記第 1 のメモリ部に標準通信方式ソフトウェアに替えて記憶することを特徴とする請求項 3 記載の無線端末。

【請求項 6】 少なくとも、予め定められた一の通信方式ソフトウェアによって、当該一の通信方式ソフトウェアとは異なる複数の種類の通信方式ソフトウェアを、無線端末の更新のために送信する送信手段を有することを特徴とする基地局。

【請求項 7】 前記送信手段において、複数の種類の通信方式ソフトウェアは、その最新バージョンの情報を含んでいることを特徴とする請求項 6 記載の基地局。

【請求項 8】 前記送信手段は、複数の種類の通信方式ソフトウェアを常時送信していることを特徴とする請求項 6 記載の基地局。

【発明の詳細な説明】

【0001】

【発明の属する技術分野】本発明は、ソフトウェア無線技術を用いた無線端末及びその基地局において、無線インタフェース等の通信方式ソフトウェアの更新に関するものである。

【0002】

【従来の技術】高度道路交通システム（Intelligent Transport System、以下、ITS と称する）として、例えば、道路の路側帯の所々に設置された無線ビーコンと車載端末との路車間通信を行うことによって、無線ビーコンから伝達される道路交通情報を受信し、車載端末画面に経路案内や行先までの所要時間を表示させるシステムや、高速道路における料金課金のための電子通行料徴収システムが実用化されつつある。また、今後はさらに車両間通信を行うことによって、より一層の安全運転を実現するシステムも考えられている。

【0003】このように、ITS を例に挙げてても多種のシステムが提案されているように、これらシステムに

使用される無線端末は、多種類のシステムに対して適応できる必要がある。また、通信技術の急速な発展によって、これら各システムは2、3年毎にバージョンアップする可能性を有していることから、これらシステムに使用される無線端末は、このバージョンアップに対しても適応できる必要がある。これら事情を受けて、これらシステムに使用される無線端末として、新システムの導入や既存システムの使用変更等に柔軟に対処できる無線技術としてのソフトウェア無線技術を利用する無線端末が注目されている。

【0004】

【発明が解決しようとする課題】このソフトウェア無線技術を利用した無線端末では、必要な無線信号処理はソフトウェアによって記述されており、このソフトウェアに従って、無線信号処理が実行される。したがって、その無線信号処理を更新するためには、それに対応するソフトウェアを更新すればよいことになる。

【0005】この場合、無線信号処理に対応するソフトウェアは無線端末又は基地局に内蔵されているメモリに蓄えられているので、このメモリの記憶内容を書き換えることによって行われている。この書き換え方法の1つとしては、例えば新たな無線信号処理のソフトウェアを記憶させたICメモリカードから、当該ソフトウェアを無線端末のメモリに転送する方法がある。しかし、この方法は、ソフトウェアの更新毎にICメモリカードを用意する必要があるという問題点がある。

【0006】また、上記ITSサービスの場合、その通信方法や無線インタフェースを更新させたい意向は、サービス側の意向であるので、ユーザにはできるだけ負担をかけない方法が望まれる。したがって、サービス提供者が、基地局を介して、無線によって無線信号処理に対応するソフトウェアの更新データをユーザの無線端末に送信し、当該無線端末におけるITSサービスの通信方法や無線インタフェースを更新させる方式の確立が必要である。

【0007】そこで、基地局から無線で更新データを無線端末に送信しようとする、まず、どの無線方式を用いて送信するのが好適であるかという課題が発生する。さらに、ユーザの無線端末の無線通信方式は利用しているサービスによっても異なる。例えば、転送レートが低い通信方式によってサービスを受けている場合に、大量の更新データをこの通信方式で送信すると、転送時間を長く取ってしまい、ユーザにとって使い勝手の悪いものになる。一方、ユーザが高速転送可能なサービスを使用している場合は、そのサービスが有料である可能性もあり、この場合には、更新のために料金が発生するので、この料金を誰が支払うかといった問題も発生する。

【0008】一方、ユーザが現在使用している無線通信方式において、無線インタフェースはそのままで、信号処理プロトコルを更新させたい場合、さらには、別のサ

ービスの別の無線通信方式に変更し、かつその無線通信方式の最新バージョンによって通信したい、すなわち、変更と更新を同時に行いたい場合等、更新するときの状況を踏まえた更新方式を確立する必要がある。

【0009】本発明は、上記問題点を鑑み、信号処理プロトコルや無線インタフェースといった通信方式ソフトウェアの更新を効率よく行うことができる無線端末並びにその通信方式ソフトウェアの更新プログラムを記録した記録媒体、及びその基地局を提供することを目的とする。

【0010】

【課題を解決するための手段】本発明の無線端末は、内蔵されるソフトウェアによって規定される通信方式で基地局から発せられる無線信号を受信して基地局から情報データを取得する無線端末であって、基地局から情報データを取得するときの通信方式を規定する通信方式ソフトウェアが記憶されている第1の記憶部と、該第1の記憶部に記憶されている通信方式ソフトウェアに替え、基地局から更新された通信方式ソフトウェアを取得するときの通信方式を規定する標準通信方式ソフトウェアが記憶されている第2の記憶部とを有し、前記第1の記憶部に記憶されている通信方式ソフトウェアの更新に際し、基地局から発せられる無線信号を前記第2の記憶部に記憶されている標準通信方式ソフトウェアで受信して当該基地局から更新された通信方式ソフトウェアを取得するとともに、当該取得した更新された通信方式ソフトウェアを前記第1の記憶部に更新記憶することを特徴とする。

【0011】本発明の無線端末の通信方式ソフトウェアの更新は、コンピュータによって無線端末の通信方式ソフトウェアを変更するためのプログラムを記録した記録媒体によってなされ、該プログラムは無線端末の通信方式ソフトウェアの更新の際、無線端末の今まで使用されていた通信方式ソフトウェアを予め定められている標準通信方式ソフトウェアに替えさせ、基地局から標準通信方式ソフトウェアで無線送信される更新通信方式ソフトウェアを標準通信方式ソフトウェアで受信させ、当該受信した更新通信方式ソフトウェアを前記標準通信方式ソフトウェアに替えさせることを特徴とする。

【0012】また、本発明の無線端末は、無線で受信されるアナログ信号をデジタル信号に変換するアナログデジタル変換手段と、該アナログデジタル変換手段から出力されるデジタル信号をソフトウェア処理によって復調する復調手段と、該復調手段に復調処理のためのソフトウェアを供給する処理ソフトウェア供給手段と、前記各手段の動作仕様を制御するための制御信号を供給する制御信号供給手段と、前記処理ソフトウェア供給手段が供給するソフトウェアと該制御信号供給手段が供給する制御信号とを含めた通信方式ソフトウェアを記憶する第1のメモリ部と、該第1のメモリ部に記憶され

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ている通信方式ソフトウェアを更新するための標準通信方式ソフトウェアを記憶する第2のメモリ部とを備え、前記第1のメモリ部の通信方式ソフトウェアの更新に当たっては、前記第1のメモリ部に前記第2のメモリ部に記憶されている標準通信方式ソフトウェアを更新記憶し、該標準通信方式ソフトウェアによって前記処理ソフトウェア供給手段及び制御信号供給手段を介して作動される前記アナログデジタル変換手段及び復調手段によって更新された通信方式ソフトウェアを無線によって受信し、該更新された通信方式ソフトウェアを前記第1のメモリ部に標準通信方式に替えて記憶することを特徴とする。

【0013】さらに、前記第1のメモリ部には、当該第1のメモリ部に記憶されている通信方式ソフトウェアの更新の度に、今まで使用していた通信方式ソフトウェアが逐次保存記憶される第3のメモリ部が付設されていることを特徴とする。さらにまた、前記第1のメモリ部に記憶されている通信方式ソフトウェアの更新に際しては、更新される通信方式ソフトウェアの無線インタフェースが今まで使用していた通信方式ソフトウェアの無線インタフェースと同一か否かを判定し、同一でない場合にのみ、前記第1のメモリ部に前記第2のメモリ部に記憶されている標準通信方式ソフトウェアを更新記憶し、前記処理ソフトウェア供給手段及び制御信号供給手段を介して該標準通信方式ソフトウェアによって作動される前記アナログデジタル変換手段及び復調手段によって更新された通信方式ソフトウェアを無線によって受信し、該更新された通信方式ソフトウェアを前記第1のメモリ部に標準通信方式ソフトウェアに替えて記憶することを特徴とする。

【0014】これに対し、本発明の無線端末の基地局は、少なくとも、予め定められた一の通信方式ソフトウェアによって、当該一の通信方式ソフトウェアとは異なる複数の種類の通信方式ソフトウェアを、無線端末の更新のために送信する送信手段を有することを特徴とする。

【0015】さらに、前記送信手段において、複数の種類の通信方式ソフトウェアは、その最新バージョンの情報を含んでいることを特徴とする。さらにまた、前記送信手段は、複数の種類の通信方式ソフトウェアを常時送信していることを特徴とする。

【0016】

【発明の実施の形態】以下、添付図面を参照しながら本発明の好適な実施の形態について詳細に説明する。図1は、本発明の一実施の形態によるソフトウェア無線技術を用いた路車間通信を主体とする無線端末Tの受信側の信号系統図である。無線端末Tには、路車間通信用のアンテナ1が備えられており、アンテナ1は周波数変換回路2に接続されている。周波数変換回路2はアンテナ1で受信した高周波信号をベースバンド信号帯域まで周波

数変換するものである。

【0017】周波数変換回路2の出力は、ベースバンド信号帯域以外の不要信号を取り除くためのフィルタ3を介して、アナログデジタル変換器（以下、A/D変換器と称する）4に供給される。A/D変換器4は、フィルタ3の出力のアナログ信号を標本化し、量子化してデジタル信号に変換する構成になっている。

【0018】A/D変換器4の出力は、復調回路5に接続されている。この復調回路5では、A/D変換器4の出力信号からデジタル信号処理によって変調信号を復調し、この復調信号は情報取得及び出力装置6に供給されるようになっている。情報取得及び出力装置6は、復調回路5から供給される復調信号を所定のプロトコルに従い、情報データに変換するデータ取得処理、並びに、その取得データに基づきその情報データの一部を表示デバイス7に出力し、または、関連データ部を図示せぬ車載コンピュータに出力し、さらに、通信方式ソフトウェアを更新する場合の更新データ部を後述するメモリに出力する等の操作を行う。

【0019】なお、前記復調回路5、情報取得及び出力装置6はその信号処理がソフトウェアによって規定されるもので、その信号処理用ソフトウェアは、ソフトウェア供給回路9から与えられるようになっている。また、前記周波数変換回路2、フィルタ3、A/D変換器4、復調回路5、情報取得及び出力装置6の各回路は、それぞれの無線インタフェース、信号処理のプロトコル等に応じて、所定の動作仕様が規定されるので、その動作仕様を制御するための信号が制御信号供給回路8によって与えられるようになっている。

【0020】ここで、本実施の形態においては、この信号処理用ソフトウェア（無線インタフェースを含む）及び制御信号（信号処理のプロトコルを含む）を1つにまとめたものを通信方式ソフトウェアと呼ぶ。そして、この通信方式ソフトウェアを変更することによって、無線インタフェース、信号処理のプロトコル等の変更が可能になり、無線端末Tは複数の無線インタフェース、複数のプロトコルに対応することになる。

【0021】ところで、本実施の形態においては、通信方式ソフトウェアは無線端末Tのメモリ手段10の各メモリ部10-1〜4に記憶されている。メモリ部10-1は現在使用している通信方式ソフトウェアを記憶し、メモリ部10-2は標準の通信方式ソフトウェアを記憶し、メモリ部10-3は無線端末Tが保有する複数個の通信方式ソフトウェアを記憶し、メモリ部10-4は情報取得及び出力装置6によって基地局Uから送られてきた更新用の通信方式ソフトウェアを記憶する構成になっている。

【0022】そして、伝送系を通過してきた更新用の通信方式ソフトウェアのデータは誤りが残留していたり、第三者による不正な処理が加えられている可能性を持っ

ているため、メモリ部10-4は、さらにチェック回路11とも接続され、チェック回路11は、メモリ部10-4に送られてきた更新用の通信方式ソフトウェアに含まれる暗号データ、誤り訂正符号データ等によって、残留誤り、不正の有無のチェック等を行うようになっている。

【0023】上述したように無線端末Tの受信側の信号系統は構成され、その各部は制御手段12によって作動を制御されるが、この無線端末Tは、複数の無線インタフェース、信号処理のプロトコルに対応するだけではなく、例えば、ITSサービス者が通信技術の進歩、ITS及び道路インフラの整備・進歩に応じて、無線インタフェース、信号処理プロトコル等の更新を行い、より良いサービスを供給する役目も持っている。

【0024】図2は、上述した無線端末Tに対する基地局Uの信号系統構成の一部を示す図である。ITSサービス情報等の無線端末Tへの提供情報を供給する情報発生装置21、及び更新用通信方式ソフトウェア並びにそのバージョン情報などを供給する更新データ発生装置22は、多重化装置23に接続されている。多重化装置23は情報発生装置21及び更新データ発生装置からの情報データを多重化し、その多重化された情報データは、増幅回路24を介して、アンテナ25から無線端末Tへ向け

て送信されるようになっている。

【0025】図3及び図4は、無線端末Tにおける無線インタフェース、信号処理のプロトコル等の更新手続の処理構成を示すフローチャートである。なお、無線端末Tが使用していた直前の通信方式ソフトウェアを仮にB方式、また標準の通信方式ソフトウェアを仮にC方式として説明する。すなわち、現在使用している通信方式ソフトウェアを記憶するメモリ部10-1には、B方式の通信方式ソフトウェアが記憶され、標準の通信方式ソフトウェアを記憶するメモリ部10-2には、C方式の通信方式ソフトウェアが記憶されているものとする。

【0026】今この状況で、基地局Uから通信方式ソフトウェアの更新の希望があったとする(ステップS1)。この基地局Uから無線端末Tへの当該希望は、無線インタフェースの変更に係る場合は、いままで基地局Uと無線端末Tとの間で使用していた通信方式ソフトウェア(すなわちB方式)にかかわらず、C方式の通信方式ソフトウェアでこの希望が無線端末Tへ伝送されるようになっている。

【0027】これに対し、この基地局Uから無線端末Tへの当該希望が、無線インタフェースの変更は必要とせず、信号処理のプロトコルの変更に関するものであるならば、今まで使用していたのと同じB方式の通信方式ソフトウェアでこの希望が無線端末Tへ伝送されるようになっている。そして、基地局Uから通信方式の更新の希望を受けた無線端末Tは、最初に、基地局Uから更新する無線インタフェースがいままで使用していた無線イン

タフェースと同一であるかチェックし、異なる場合と同一である場合とで、違う更新処理を行う(ステップS2)。

【0028】図3は異なる無線インタフェースを用いる場合の処理を、図4は同一の無線インタフェースを用いる場合の処理を示すフローチャートである。まず、異なる無線インタフェースを用いる場合は、図3に示すように、メモリ部10-1で動作していたB方式の通信方式ソフトウェアのバージョンと、メモリ部10-3に以前から蓄えられていたB方式の通信方式ソフトウェアのバージョンとを比較し、最新バージョンの方をメモリ部10-3の所定のエリアに保存する(ステップS3)。

【0029】ついで、メモリ部10-2から標準の通信方式ソフトウェアであるC方式をメモリ部10-1にロードする(ステップS4)。これにより、この後は、無線端末Tは、B方式の通信方式ソフトウェアに代わり、C方式の標準の通信方式ソフトウェアによって動作することになる。

【0030】すなわち、周波数変換回路2、フィルタ3、A/D変換器4、復調回路5、情報取得及び出力装置6の各回路の動作仕様も、制御信号供給回路8から与えられる信号によって、それぞれの無線インタフェース、信号処理のプロトコルとして、C方式の動作仕様が規定されることになる。したがって、復調回路5及び情報取得及び出力装置6の信号処理用ソフトウェアは、ソフトウェア供給回路9からC方式の信号処理用ソフトウェアが与えられるようになる。

【0031】これにより、更新のための通信方式ソフトウェアはC方式で基地局Uから無線端末Tへ伝送されることが予め決められていることから、基地局Uと無線端末Tとの間は、通信方式ソフトウェアがC方式で相互に一致し、種々の通信方式ソフトウェアの最新バージョンが、C方式の通信方式ソフトウェアで、各回路2〜6を介してメモリ部10-4に取り込めることになる(ステップS5)。

【0032】例えば、この状態において、情報取得及び出力装置6によって、F方式の通信方式ソフトウェアを取得した場合は、メモリ部10-4にはF方式の通信方式ソフトウェアが記憶されることになる。ここで、このメモリ部10-4に記憶された通信方式ソフトウェアのF方式が正常に伝送されてきたものか否かをチェックするため、チェック回路11が作動する(ステップS6)。チェック回路11は暗号技術等を利用して、通信方式ソフトウェアが不正に修正されているものか否かをチェックするとともに、通信方式ソフトウェアのデータに誤りが残留しているか否かを誤り訂正技術を用いてチェックし、誤りを除去する。そして、このチェックに合格しない場合は、再度、F方式の通信方式取得ソフトウェアを取得し、処理を繰り返す(ステップS5、S6)。

【0033】この後、正常なF方式の通信方式ソフトウェアがメモリ部10-4に得られたときには、メモリ部10-4からメモリ部10-1にロードする(ステップS7)。これによって、無線端末TはF方式の通信方式ソフトウェアの無線端末として動作することになる。そのために、まず、無線端末Tは、図示せぬ発信側の作動によって、F方式の通信方式ソフトウェアのテスト信号を送信するように、F方式の通信方式ソフトウェアの基地局Uに要求し、更新時におけるテスト信号を受信する。

【0034】基地局UからのF方式の通信方式ソフトウェアのテスト信号を無線端末Tが受信すると、無線端末Tは情報取得及び出力装置6等を介して関連データ部を図示せぬ車載コンピュータに伝達し、車載コンピュータで再度チェックすることになる(ステップS8)。そして、このチェックの結果がOKであれば、更新したF方式のソフトウェアを用いて、ITSサービスを受けることになる(ステップS9)。

【0035】一方、このチェックの結果が異常を示せば、テスト結果に応じて、更新したF方式の通信方式ソフトウェアの変更を行い(ステップS10)、変更後、再度、そのF方式の通信方式ソフトウェアをメモリ部10-1にロードし(ステップS7)、テストを再度行い(ステップS8、10)、正常化する。ところで、前記ステップS2で、同一の無線インタフェースを用い、無線インタフェースの変更は必要とせず、信号処理のプロトコルの変更に関する確認された場合は、無線端末Tは図4に示すような処理を行う。

【0036】すなわち、無線インタフェースは変化がないので、メモリ部10-1の内容は変更しないまま、通信方式ソフトウェアのB方式のバージョンアップとしてのBv方式の通信方式ソフトウェアを、情報取得及び出力装置6によってメモリ部10-4に取得し(ステップS11)、チェック回路11によって、前述した図3のステップS5と同様な処理を行い、取得したBv方式の通信方式ソフトウェアの内容を検査する(ステップS12)。これにより、正常な通信方式ソフトウェアのBv方式が得られている場合は、メモリ部10-1に記憶されているB方式の通信方式ソフトウェアをメモリ部10-3に保存した上(ステップS13)、メモリ部10-4の内容をメモリ部10-1にロードして(ステップS14)、無線端末TをBv方式の通信方式ソフトウェアで動作させる。

【0037】さらに、前述した図3のステップS8~10と同様に、通信方式ソフトウェアのBv方式のテスト信号を基地局Uから送信するように依頼し、そのテスト信号を受信して、通信方式ソフトウェアのBv方式が正常に動作するか否かをチェックする(ステップS15)。そして、このチェックの結果がOKであれば、更新したBv方式のソフトウェアを用いて、ITSサービ

スを受けることになる一方(ステップS16)、このチェックの結果が異常を示せば、テスト結果に応じて、更新したF方式の通信方式ソフトウェアの変更を行い(ステップS17)、変更後、再度、そのF方式の通信方式ソフトウェアをメモリ部10-1にロードし(ステップS14)、テストを再度行い(ステップS15、17)、正常化する。

【0038】図5は、ユーザが更新に関して、特に気をつけなくてもよいように、自動的に通信方式ソフトウェアを更新する処理を示すフローチャートである。この自動更新に当たっては、無線端末Tを、例えば、予め所定の時間間隔、例えば毎早朝毎に、標準方式であるC方式の通信方式ソフトウェアの無線端末Tとして動作させるように設定しておくことによって行われる。

【0039】そして、無線端末Tはこの設定時刻になると、メモリ部10-1に今まで記憶されていた例えばB方式の通信方式ソフトウェアのバージョンと、メモリ部10-3に以前から蓄えられていたB方式の通信方式ソフトウェアのバージョンとを比較し、最新バージョンの方をメモリ部10-3の所定のエリアに保存し(ステップS21)、メモリ部10-2から標準の通信方式ソフトウェアであるC方式をメモリ部10-1にロードする(ステップS22)。

【0040】その上で、無線端末Tは、標準の通信方式ソフトウェアであるC方式で基地局Uに対し、メモリ部10-3に以前から蓄えられている複数の通信方式ソフトウェアについて、予め定められた順番に従って一の通信方式ソフトウェアの最新バージョンの値を送信するように要求し、基地局Uから当該一の通信方式ソフトウェアの最新バージョンの値を取得する。この取得した値とメモリ部10-3に記憶されている無線端末Tが保有する複数の通信方式ソフトウェアのバージョンの値とを比較し、メモリ部10-3に記憶されている各通信方式ソフトウェアのバージョンが最新のものであるか否かをチェックする(ステップS23)。

【0041】最新のバージョンではない通信方式ソフトウェアであるのが前記チェックによって確認された場合は、無線端末Tは、基地局Uに対して当該通信方式ソフトウェアの最新バージョンの送信を要求し、前述した図3、図4のステップS5~S8の処理を行うことによって、当該通信方式ソフトウェアの最新バージョンをメモリ部10-3に獲得する(ステップS24)。

【0042】そして、メモリ部10-3に以前から蓄えられている複数の通信方式ソフトウェアについて、全ての通信方式ソフトウェアが最新バージョンであることを確認し(ステップS25)、これが確認できたならば自動更新処理を終了する一方、まだ確認されていない通信方式ソフトウェアが残っている場合は、上記したステップS23~ステップS25の処理を繰り返し行う。

【0043】以上、本発明の無線端末及びその基地局の

実施の形態について説明したが、本発明は上記実施の形態に限定されるものではない。例えば、上記説明した実施の形態では、無線インタフェースに変更がなく、その他の信号処理プロトコルが更新される場合で、通信方式ソフトウェアがB方式からバージョンアップされたBv方式に更新される場合の処理を、図4に示すようにし、無線インタフェースに変更ある場合の図3に示す処理と異なるようにしたが、当然図3に示す処理によっても、B方式からBv方式への通信方式ソフトウェアの変更は可能で、図3及び図4におけるステップS2及びステップS11～ステップS16の処理は、削除可能である。

【0044】また、図3のステップS8において、更新するF方式でテスト信号を送信するように、F方式の送信方式ソフトウェアの基地局に要求し、また図5のステップS22、23においては、C方式の送信方式ソフトウェアの基地局に、メモリ部10-3に以前から蓄えられている複数の通信方式ソフトウェアについて最新バージョンの値を送信するように要求するようにしているが、このテスト信号や、最新バージョン情報を常時基地局が送信する構成の場合は、無線端末側から当然そのような要求をしなくとも、テスト信号や、最新バージョン情報が取得できることは言うまでもない。

【0045】さらに、上記説明した実施の形態では、ITSサービスを中心とした無線端末並びにその基地局を例に説明したが、アンテナ、A/D変換器、メモリを含む回路規模及び回路動作速度等の性能向上に伴い、ソフトウェア無線技術は種々の無線システムに適用可能であり、前述した送信方式ソフトウェアの更新方法はITS関連の無線システムに制限されるものではない。

【0046】また、本発明は、コンピュータを上記無線端末として機能させるためのプログラムを記録したコンピュータ読み取り可能な記録媒体であってもよく、例えば、磁気テープ、C-D-ROM、ICカード、RAMカード等のいかなるタイプの記録媒体であってもよい。

【0047】

【発明の効果】以上のように、本発明によれば、通信方式ソフトウェアの更新を一の標準通信方式ソフトウェアで行うため、更新以前に使用していた通信方式ソフトウェアに依存しない更新手続きとなる。そのため、更新手続きを一の標準通信方式ソフトウェアで統一できるの

で、不正防止にも効率的な対策が取れることになり、情報インフラに対するコストの節約になる。さらに、更新手続きが容易なので、サービス提供者側でサービスのアップグレードを適時行えることを意味し、安全や快適が使命であるITSサービスにおけるような情報通信サービスにおいて、ユーザに大きなメリットを与える。そして、本発明によれば、無線端末における無線インタフェースや信号処理プロトコルの更新手続きが確立され、無線端末の有効性を十分に発揮させることができる。

【図面の簡単な説明】

【図1】本発明の一実施の形態によるソフトウェア無線技術を用いた路車間通信を主体とする無線端末Tの受信側の信号系統図である。

【図2】無線端末Tに対する基地局Uの信号系統構成の一部を示す図である。

【図3】無線端末Tにおける無線インタフェース、信号処理のプロトコル等の更新手続きの処理構成を示すフローチャートである。

【図4】無線端末Tにおける無線インタフェースを変更しない場合、信号処理のプロトコル等の更新手続きの処理構成を示すフローチャートである。

【図5】自動的に通信方式ソフトウェアを更新する処理を示したフローチャートである。

【符号の説明】

T 無線端末

U 基地局

1 アンテナ

2 周波数変換回路（周波数変換手段）

4 アナログデジタル変換器（アナログデジタル変換手段）

5 復調回路（復調手段）

6 情報取得及び出力装置

8 制御信号供給回路（制御信号供給手段）

9 ソフトウェア供給回路（処理ソフトウェア供給手段）

10 メモリ手段

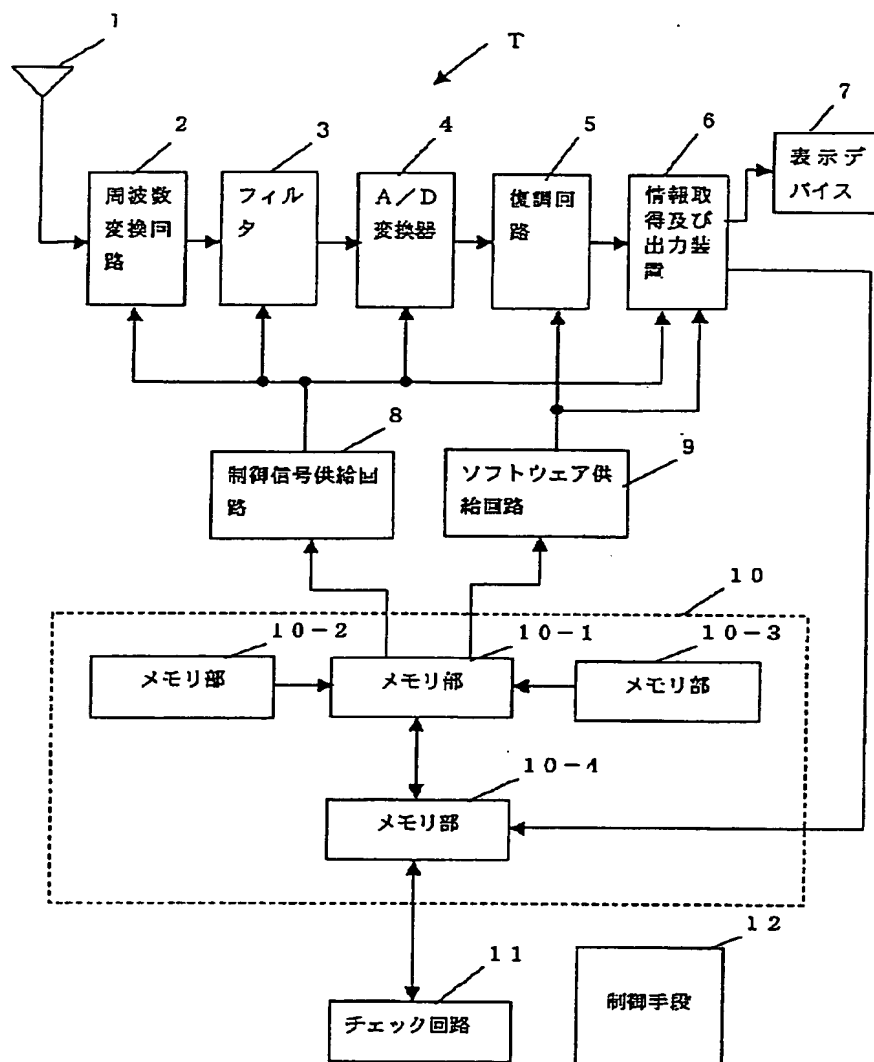
10-1 メモリ部（第1の記憶部、第1のメモリ部）

10-2 メモリ部（第2の記憶部、第2のメモリ部）

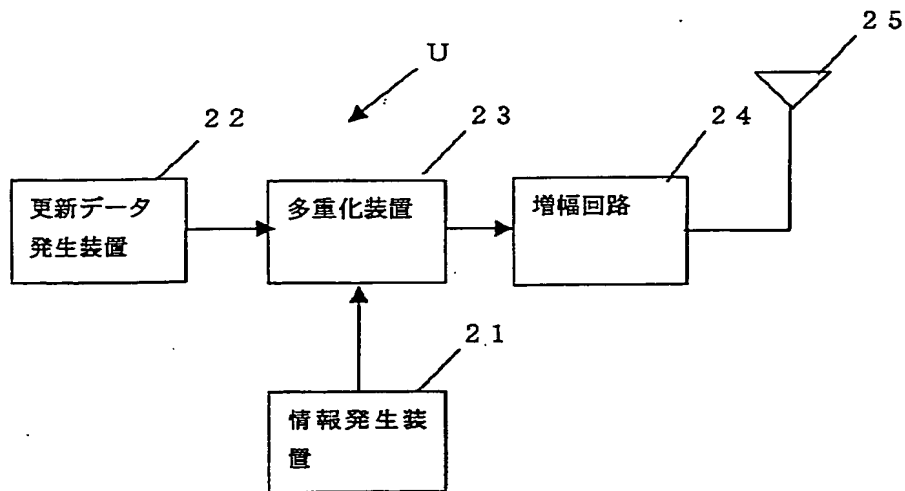
10-3 メモリ部（第3のメモリ部）

11 チェック回路（チェック手段）

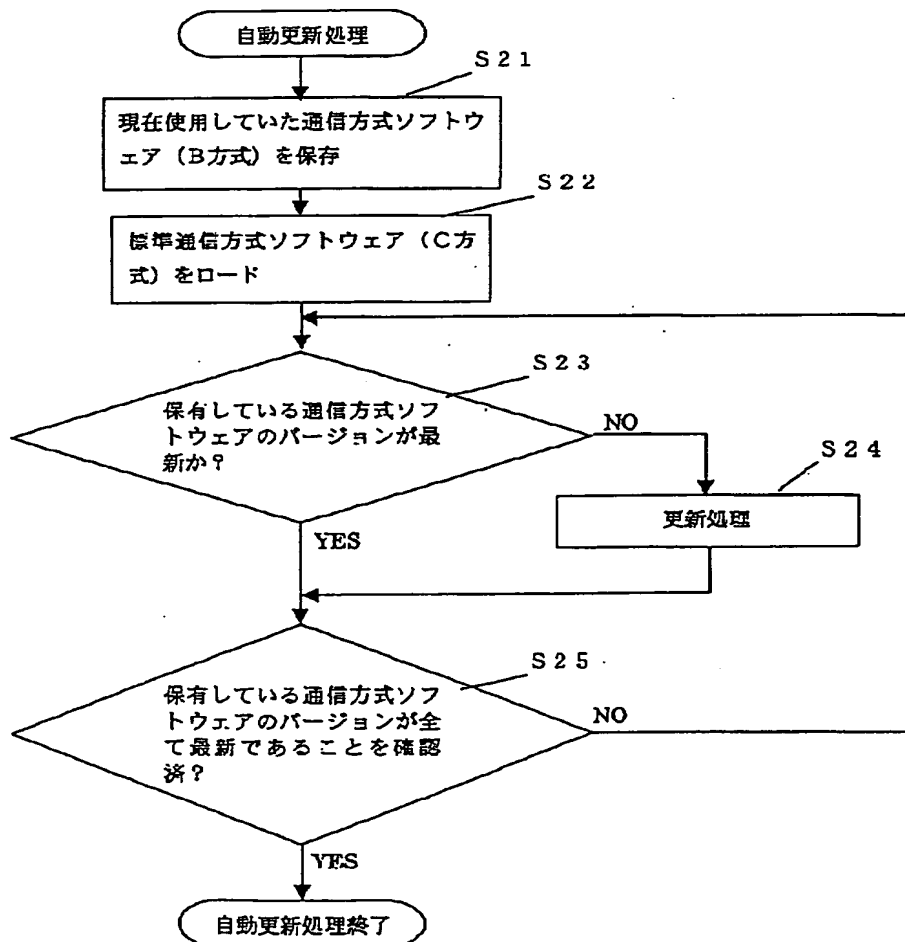
【図1】



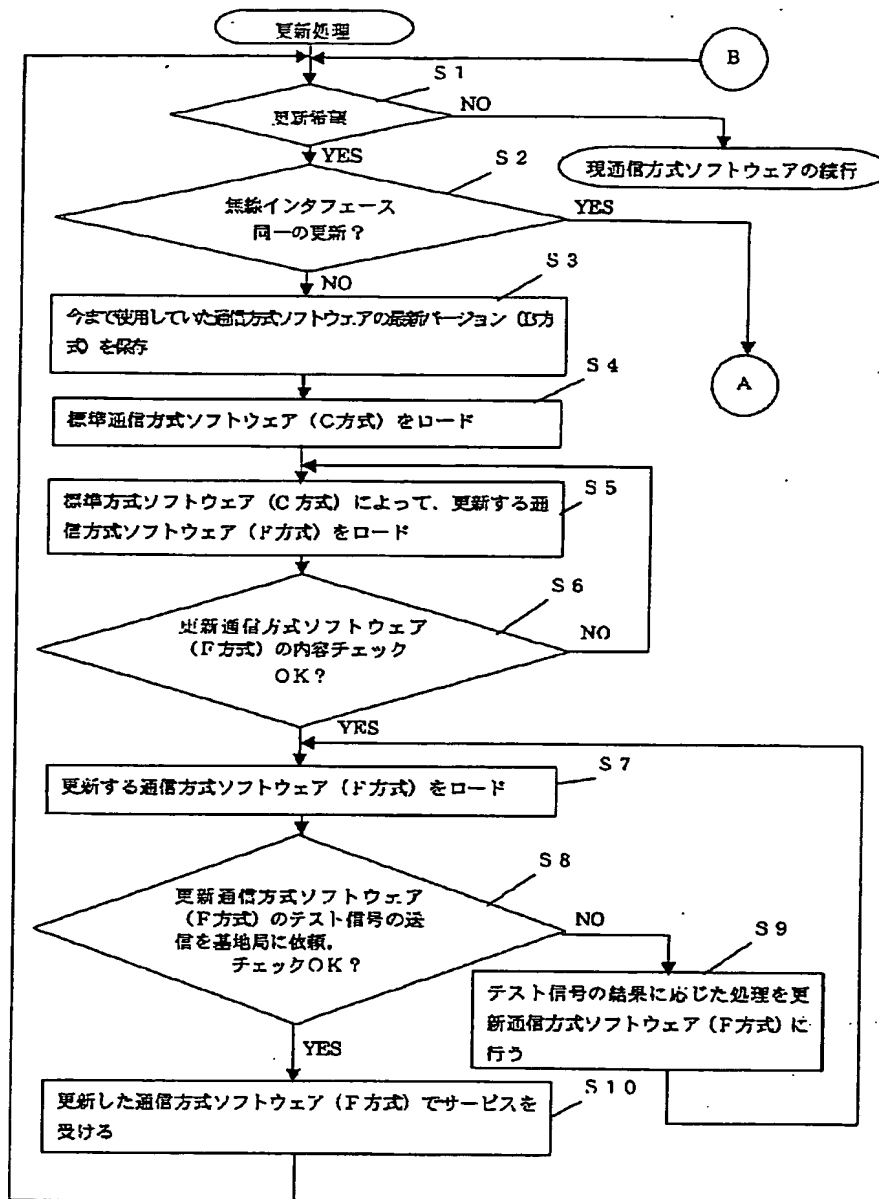
【図2】



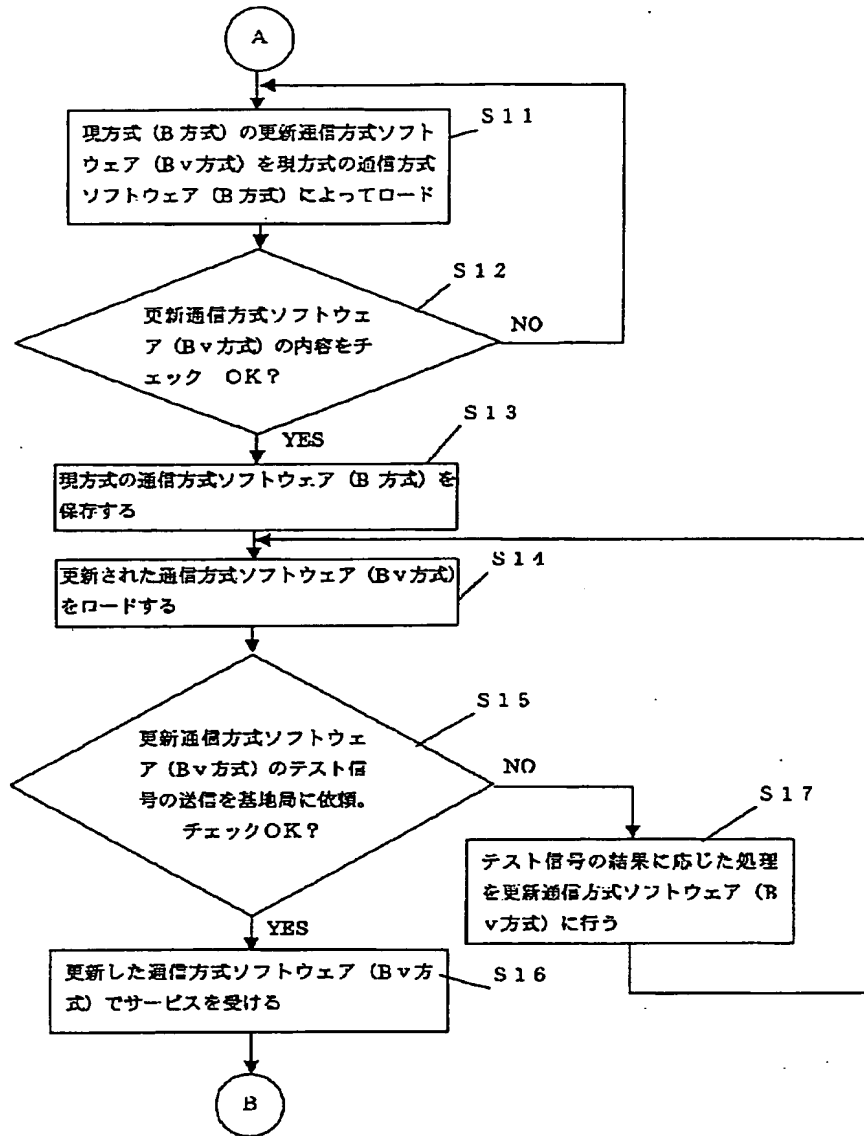
【図5】



【図3】



【図4】



フロントページの続き

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